Adding and Subtracting Vectors

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Preliminaries and Objectives

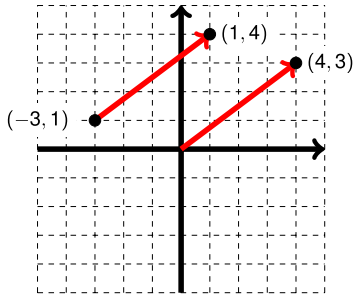
Preliminaries

- Cartesian Coordinate System
- Vectors

Objectives

- Add vectors
- Subtract vectors
- Scale vectors

Location of Vectors



Finding Vector Components

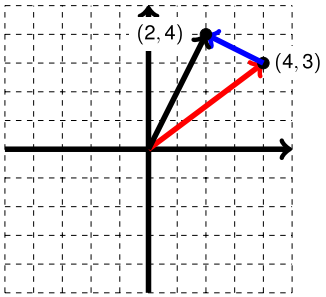
To find the vector $\vec{v}$ that begins at (x_1, y_1) and ends at (x_2, y_2), subtract the beginning coordinates from the ending coordinates.

That is $\vec{v} = \langle x_2 - x_1, y_2 - y_1 \rangle$

Example: If vector $\vec{v}$ begins at $(-3, 1)$ and ends at $(1, 4)$, then

$$\vec{v} = \langle 1 - (-3), 4 - 1 \rangle = \langle 4, 3 \rangle$$

Adding Vectors



Adding Vectors

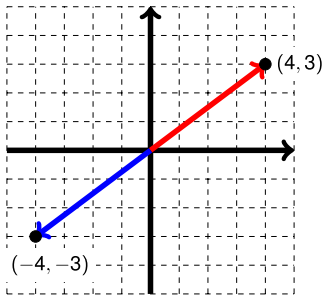
To add the vectors $\vec{u} = \langle u_1, u_2 \rangle$ and $\vec{v} = \langle v_1, v_2 \rangle$, add the coordinates.

That is $\vec{u} + \vec{v} = \langle u_1 + v_1, u_2 + v_2 \rangle$

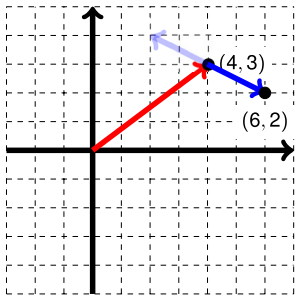
Example: If vector $\vec{u} = \langle 4, 3 \rangle$ and $\vec{v} = \langle -2, 1 \rangle$, then

$$\vec{u} + \vec{v} = \langle 4 - 2, 3 + 1 \rangle = \langle 2, 4 \rangle$$

The Opposite of a Vector



Subtracting Vectors



Subtracting Vectors

The opposite of $\vec{u} = \langle u_1, u_2 \rangle$ is $-\vec{u} = \langle -u_1, -u_2 \rangle$

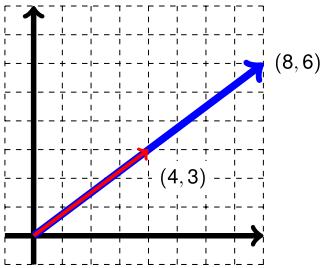
To subtract the vectors $\vec{u} = \langle u_1, u_2 \rangle$ and $\vec{v} = \langle v_1, v_2 \rangle$, subtract the coordinates.

That is $\vec{u} - \vec{v} = \langle u_1 - v_1, u_2 - v_2 \rangle$

Example: If vector $\vec{u} = \langle 4, 3 \rangle$ and $\vec{v} = \langle -2, 1 \rangle$, then

$$\vec{u} - \vec{v} = \langle 4 - (-2), 3 - 1 \rangle = \langle 6, 2 \rangle$$

Scaling Vectors



Scaling Vectors

To find the vector that is k times as long as $\vec{v} = \langle v_1, v_2 \rangle$, multiply each coordinate of $\vec{v}$ by k

That is $k\vec{v} = \langle kv_1, kv_2 \rangle$

Example: If vector $\vec{v} = \langle 4, 3 \rangle$, then

$$2\vec{v} = \langle 8, 6 \rangle$$

Recap

Adding vectors:
$\vec{u} + \vec{v} = \langle u_1 + v_1, u_2 + v_2 \rangle$

Subtracting vectors:
$\vec{u} - \vec{v} = \langle u_1 - v_1, u_2 - v_2 \rangle$

Scaling vectors:
$k\vec{v} = \langle kv_1, kv_2 \rangle$